

## CLAIMS

What is claimed is:

1. Apparatus for cleaning or de-icing a vehicle window, comprising:  
a reservoir for containing therein a washing fluid;  
5 a vessel having an inlet through which the washing fluid is received from the reservoir  
and an outlet through which the fluid is discharged for cleaning a vehicle window; and  
a first heating element disposed in the vessel for heating the fluid in the vessel;  
characterized by  
an auxiliary heating element being disposed in the vessel for heating the fluid in the  
10 vessel, wherein said auxiliary heating element is disposed at a bottom portion of the vessel  
and is operative to heat a quantity of fluid which is not necessarily sufficient to cover the first  
heating element.
2. Apparatus according to claim 1 and further comprising a plurality of sensors which  
feed data concerning at least one of a temperature and a fluid level of the fluid in the vessel to  
15 a controller, said controller controlling energization of the first and auxiliary heating elements  
in response to the data.
3. Apparatus according to claim 1 and further comprising a temperature sensor mounted  
in said auxiliary heating element.
4. Apparatus for cleaning or de-icing a vehicle window, comprising:  
20 a reservoir for containing therein a washing fluid;  
a vessel having an inlet through which the washing fluid is received from the reservoir  
and an outlet through which the fluid is discharged;  
a spray head in fluid communication with the outlet through which the fluid is sprayed  
onto a vehicle window; and  
25 a heating element disposed in the vessel for heating the fluid in said vessel;  
characterized by  
a temperature sensor mounted in propinquity to said spray head, said temperature  
sensor being in communication with a controller which controls heating of said heating  
element in response to a temperature sensed by said temperature sensor.
5. Apparatus for cleaning or de-icing a vehicle window, comprising:  
30 a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir and an outlet through which the fluid is discharged;

a spray head in fluid communication with the outlet through which the fluid is sprayed onto a vehicle window; and

5 a heating element disposed in the vessel for heating the fluid in said vessel;  
characterized by

a wind speed sensor in communication with a controller, wherein said controller correlates a wind speed sensed by said wind speed sensor to a temperature of the fluid sprayed from the spray head, and controls heating of said heating element in response to the wind  
10 speed sensed by said wind speed sensor.

6. Apparatus according to claim 5 and further comprising a vehicle speed sensor, wherein said controller also correlates a vehicle speed sensed by said vehicle speed sensor to a temperature of the fluid sprayed from the spray head, and controls heating of said heating element in response to the vehicle speed sensed by said vehicle speed sensor.

15 7. Apparatus for cleaning or de-icing a vehicle window, comprising:

a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir and an outlet through which the fluid is discharged for cleaning a vehicle window; and

a first heating element disposed in the vessel for heating the fluid in the vessel;

20 characterized by

a pumping system in fluid communication with said reservoir and said vessel which selectively pumps fluid from said reservoir to said vessel and drains said fluid from said vessel back to said reservoir.

8. Apparatus according to claim 7 and wherein said pumping system comprises at least  
25 one solenoid in fluid communication with said reservoir and said vessel and switchable from a first position to a second position, wherein in said first position said at least one solenoid permits flow from said reservoir to said vessel and substantially prevents draining said fluid from said vessel back to said reservoir, and wherein in said second position said at least one solenoid permits draining said fluid from said vessel back to said reservoir and substantially  
30 prevents flow from said reservoir to said vessel.

9. Apparatus according to claim 7 and wherein said pumping system comprises a reversible pump which in a first operating orientation pumps said fluid from said reservoir to

said vessel and in a second operating orientation pumps said fluid from said vessel back to said reservoir.

10. Apparatus according to claim 9 and wherein said reversible pump comprises a geared pump.

5 11. Apparatus for cleaning or de-icing a vehicle window, comprising:  
 a reservoir for containing therein a washing fluid;  
 a vessel having an inlet through which the washing fluid is received from the reservoir  
 and an outlet through which the fluid is discharged;  
 a spray head in fluid communication with the outlet through which the fluid is sprayed  
 10 onto a vehicle window;  
 a windshield wiper for wiping said window; and  
 characterized by  
 said spray head comprising a multi-outlet spray head that comprises a plurality of  
 spray outlets.

15 12. Apparatus according to claim 11 and further comprising a controller which controls a  
 spraying pattern of said plurality of outlets.

13. Apparatus according to claim 12 and further comprising a sensor for sensing an  
 angular position of said windshield wiper, wherein said controller controls the spraying  
 pattern of said plurality of outlets in accordance with the angular position of said windshield  
 20 wiper.

14. Apparatus according to claim 11 and further comprising a cam mounted on the  
 windshield wiper said cam selectively opening said outlets to permit flow of said fluid  
 therethrough.

15. Apparatus according to claim 12 and further comprising a motor which actuates the  
 25 windshield wiper and a sensor for sensing a torque of said motor, wherein said controller  
 controls the spraying pattern of said plurality of outlets in accordance with the torque of said  
 motor.

16. Apparatus according to claim 11, wherein said windshield wiper wipes said window  
 between two limits of travel, and said windshield wiper is placeable in a summer parking  
 30 mode and a winter parking mode, wherein in said summer parking mode, said wiper is at rest  
 generally at one of the limits of travel, and wherein in said winter parking mode, said wiper is  
 between said limits of travel.

17. Apparatus for cleaning or de-icing a vehicle window, comprising:

a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir and an outlet through which the fluid is discharged;

5 a spray head in fluid communication with the outlet through which the fluid is sprayed onto a vehicle window;

a windshield wiper for wiping said window; and

characterized by

10 said windshield wiper having a longitudinal bore formed therethrough for flow of the fluid therethrough, wherein said bore fluidly communicates with a plurality of outlet holes formed in said wiper for applying the fluid on said window.

18. Apparatus according to claim 17 and wherein the fluid enters said bore at one end of said wiper and an opposite end of said wiper is substantially sealed.

19. Apparatus for cleaning or de-icing a vehicle window, comprising:

15 a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir and an outlet through which the fluid is discharged for cleaning a vehicle window; and

characterized by

20 further comprising a cartridge which dispenses an additive to the fluid prior to discharging the fluid.

20. Apparatus according to claim 19 and wherein said cartridge comprises a solid block of said additive.

21. Apparatus according to claim 19 and wherein said cartridge fits into an apertured holder which is sealed by a plug, said plug comprising a threaded neck and a neck portion  
25 formed with a plurality of through holes, said holes being in fluid communication with a bore which is in turn in fluid communication with said apertured holder, and wherein said threaded neck can be screwed into a container through which the fluid can flow into the vessel, wherein the additive is mixed with the fluid as the fluid flows through said container.

22. Apparatus for cleaning or de-icing a vehicle window, comprising:

30 a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir and an outlet through which the fluid is discharged for cleaning a vehicle window; and

characterized by

further comprising a fluid authorization system for verifying use of an authorized fluid.

23. Apparatus according to claim 22 and wherein said fluid authorization system comprises a membrane constructed of a material that disintegrates if it is not in the presence of a fluid authorized for use.

24. Apparatus for cleaning or de-icing a vehicle window, comprising:

a reservoir for containing therein a washing fluid;

a vessel having an inlet through which the washing fluid is received from the reservoir

and an outlet through which the fluid is discharged for cleaning a vehicle window; and

characterized by

further comprising at least one tube in fluid communication with the fluid and a solenoid which selectively squeezes and seals said at least one tube to prevent passage of the fluid therethrough and selectively permits flow of the fluid therethrough.

25. A solenoid comprising:

a tube receiving member;

at least one tube which passes through said tube receiving member;

a shaft arranged for generally linear movement relative to said tube receiving member, said shaft selectively squeezing and sealing said at least one tube against said tube receiving member to prevent passage of the fluid therethrough, and selectively moving away from said at least one tube to permit flow of the fluid therethrough; and

electromagnetic apparatus which moves said shaft generally linearly.

26. The solenoid according to claim 25, wherein said at least one tube has a circular cross section.

27. The solenoid according to claim 25, wherein said at least one tube has a non-circular cross section.

28. The solenoid according to claim 25 and comprising two said tubes and wherein said electromagnetic apparatus moves said shaft to a position so that fluid can pass through both said tubes.

29. The solenoid according to claim 25, wherein said at least one tube has a resiliency such that when said at least one tube returns from a compressed state to a non-compressed

state, said at least one tube applies a force on said shaft to aid in the generally linear movement of said shaft.

30. Apparatus according to claim 4 further comprising apparatus to prevent damage due to freezing of the fluid.

5 31. Apparatus according to claim 30 wherein said apparatus to prevent damage comprises a platform arranged for sliding in said vessel, said platform being operative to slide due to a force of said fluid pressing thereagainst during freezing of said fluid.

32. Apparatus according to claim 30 wherein said apparatus to prevent damage comprises a cap attached to said vessel and which is operative to move away from said vessel due to a  
10 force of said fluid pressing thereagainst during freezing of said fluid.

33. Apparatus according to claim 4 further comprising apparatus for shutting off electrical supply to said heating element.

34. Apparatus according to claim 33 wherein said apparatus for shutting off electrical supply comprises a fuse electrically connected to said heating element.

15 35. Apparatus according to claim 34 wherein said fuse is internal to said vessel and is in contact with said washing fluid in said vessel.

36. Apparatus according to claim 34 wherein said fuse comprises a body to which is soldered a cap portion at a soldered connection, said cap portion being biased by a biasing device, said fuse being electrically connected to said heating element through said soldered  
20 connection, wherein upon reaching a predetermined temperature, said soldered connection becomes weakened due to at least partial melting thereof, and said biasing device urges said cap portion off said body, thereby causing a break in electrical supply to said heating element.

37. Apparatus according to claim 34 wherein said fuse is mounted on a base which is sealed with respect to said vessel by means of an endcap which presses said base against an  
25 O-ring mounted on said vessel.

38. Apparatus according to claim 33 wherein said apparatus for shutting off electrical supply comprises a fuse which is physically internal to and electrically connected to said heating element.

39. Apparatus according to claim 33 wherein said apparatus for shutting off electrical  
30 supply comprises a first FET in electrical communication with said controller, a fuse external to said vessel and operatively connected to said first FET, a second FET operatively connected to said fuse, said second FET in communication with at least one of said